# EE301 Homework #8

**Problem 1** *Evaluating CTFTs.*
Calculate the continuous-time Fourier transform for the following signals:

a) $x(t) = e^{-at}u(t)$ for $a > 0$

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b) $x(t) = \text{rect}(t)$

c) $x(t) = \text{rect}\left(\frac{t-a}{b}\right)$ for any two real numbers $a$ and $b$.

d) $x(t) = \delta(t)$

e) $x(t) = a\delta(t-b)$ for any two real numbers $a$ and $b$.

**Problem 2** *Properties of CTFTs.*
For the following problems, let $X(\omega)$ and $Y(\omega)$ be the CTFT's of $x(t)$ and $y(t)$, respectively. Calculate the CTFT of each function in terms of the functions $x(t)$, $y(t)$, $X(\omega)$, and $Y(\omega)$.

(a) $5x(t-a)$

(b) $X(t)$

(c) $x(t) * y(t)$

(d) $x(t)y(t)$

(e) $x(-t)$

(f) $x(t)e^{j\omega_0 t}$

**Problem 3** *Evaluating inverse CTFTs.*
Calculate the **inverse** CTFT for the following signals.

a) $X(\omega) = \delta(\omega)$

b) $X(\omega) = \delta(\omega - \omega_0)$

c) $X(\omega) = \text{rect}(\omega)$

**Problem 4** *Evaluating CTFTs.*

Use answers to Problems 1 and 2 above to compute the CTFT for the following signals.

a) $x(t) = \text{sinc}(t)$.

b) $x(t) = \text{sinc}\left(\frac{t-a}{b}\right)$ for any two real numbers $a$ and $b$.

c) $x(t) = 1$

d) $x(t) = e^{j\omega_0 t}$

e) $x(t) = \cos(\omega_0 t)$

f) $x(t) = \sin(\omega_0 t)$

**Problem 5** *Transfer functions for LTI systems.*

For an LTI system $T$ we have

$$T[e^{-2t}u(t)] = te^{-t}u(t) + 2e^{-2t}u(t)$$

Determine the transfer function, $H(\omega) = \frac{X(\omega)}{Y(\omega)}$, for this system.